ADVANCED SOLID MECHANICS

I Semester: M. Tech (STE)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BSTB02	Core	3	-	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OBJECTIVES:

The course should enable the students to:

I. Solve advanced solid mechanics problems using classical methods
II. Apply commercial software on select, applied solid mechanics problems.

COURSE OUTCOMES (COs):

CO 1: Understand the theory of elasticity including strain/displacement and Hooke's law relationships
CO 2: Analyse solid mechanics problems using classical methods and energy methods
CO 3: Solve for stresses and deflections of two-dimensional under unsymmetrical loading
CO 4: Obtain stresses and deflections of torsion of beams on elastic foundations
CO 5: Apply various failure criteria for general stress states at points

COURSE LEARNING OUTCOMES (CLOs):

1. Understand the Displacement, Strain and Stress Fields
2. Understand the Constitutive Relations, Cartesian Tensors
3. Solve the problems on Equations of Elasticity
4. Know the Elementary Concept of Strain
5. Understand the Strain at a Point
6. Know concept of Principal Strains and Principal Axes
7. Understand the concept of Compatibility Conditions
8. Understand the concept of Stress at a Point
9. Develop the Stress Components on an Arbitrary Plane
10. Understand the concepts on differential Equations of Equilibrium
11. Know the Hydrostatic and Deviatoric Components.
12. Understand the Equations of Equilibrium, Strain Displacement and Compatibility Relations
13. Understand the formulation of Stress- Strain relations
14. Concept of Strain Displacement
15. Understand the solutions for boundary value problems
16. Know the co-axiality of the Principal Directions
17. Understand the Plane Stress and Plane Strain Problems
18. Know the Two-Dimensional Problems in Polar Coordinates
19. Understand the Saint Venant's Method, Prandtl's Membrane Analogy
20. Formulation of Torsion of Rectangular Bar and thin plates
21. Understand the concept of Plastic Stress-Strain Relations
22. Solution of Principle of Normality and Plastic Potential, Isotropic Hardening

UNIT-I	INTRODUCTION TO ELASTICITY	Classes: 09
Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.		
UNIT-II	**STRAIN AND STRESS FIELD**	**Classes: 09**
Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.		
UNIT-III	**EQUATIONS OF ELASTICITY AND TWO-DIMENSIONAL PROBLEMS OF ELASTICITY**	**Classes: 09**
Equations of Equilibrium, Stress-Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions. Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.		
UNIT-IV	**TORSION OF PRISMATIC BARS**	**Classes: 09**
Torsion of Prismatic Bars: Saint Venant‟s Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.		
UNIT-V	**PLASTIC DEFORMATION**	**Classes: 09**
Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.		

Text Books:

1. Timoshenko and Goodier , "Theory of Elasticity" , McGraw Hill Publishing Company, 1970.
2. RagabA.R.,BayoumiS.E , "Engineering Solid Mechanics"., CRC Press,1999.
3. Kazimi S. M. A, "Solid Mechanics"., Tata McGraw Hill,1994

Reference Books:

1. SaddM.H , "Elasticity", Elsevier, 2005.
2. Ameen.M, "Computational Elasticity", Narosa, 2005.
3. KazimiS. M. A, "Solid Mechanics", Tata McGraw Hill, 1994.
4. SrinathL.S "Advanced Mechanics of Solids", Tata McGraw Hill, 2000.

Web References:

1. https://www.youtube.com/watch?v=4meZNc2wB4s&t=1464s

E-Text Books:

1. http://www.kstr.lth.se/fileadmin/kstr/pdf_files/forsk_kurs/Theory_of_elastic_stability_by_S._Timoshenko_and_J.M._Gere__1963_.pdf
2. https://brijrbedu.org/Brij%20Data/Advance%20Mechanics%20of%20Solids/Book/Advanced%20Mechanics%20of%20Solids%20By%20L.%20S.%20Srinath.pdf